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Prince Edward Island snow crab, Chionoecetes opilio, fishery stock assessment for 1987

by

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ABSTRACT

An exploratory snow crab fishery was initiated off northern Prince Edward Island with the issuance of 16 exploratory permits in 1985. Fourteen new exploratory permits were issued in 1986, for a total of 30, and the 16 initial exploratory permits were reissued as licenses in 1987. The fishery has been under no quota limitations.

During the 1987 season, pertinent biological characteristics were obtained through a sea sampling program. Catch, effort and distribution of fishing effort were obtained from fishermen's log-books and processor's sales slips.

The distribution of fishing effort in 1987 indicates the presence of one fishing ground situated in the middle of area 26. The fishing ground is delimited by the 30 fathoms contour and the zone boundaries.

Mean size of male crabs caught decreased from 111.8 mm carapace width (CW) in 1986 to 101.7 mm CW in 1987. The percentages of morphometrically immature and undersized crabs in the catch increased in 1987 compared to 1986. The increases may be a positive sign for future recruitment into the fishery, but also indicates the decrease number of larger crabs on the fishing ground.

The mean CPUE decreased by 45.4% from 1986 to 1987 (from 32.6 kg/trap haul to 17.8 kg/trap haul respectively). The total catch decreased by 63% compared with 1986, from 1239 t to 457 t. The total effort for 1987 was 25674 trap hauls, which represents a decrease of 32% from the 1986 fishing season (38003 trap hauls).

Data from the 1986 fall season have been combined with the 1987 spring season in order to estimate the initial biomass (B_0) after the period of recruitment into the fishery. The total catch for that period was 519 t. The Leslie analysis estimates the B_0 at 689 t and an exploitation level of 75.4%.

A reduction in effort is advised if increased CPUE's and long-term stock stability are desired. The fishing season should be shortened to a season coinciding with that observed by the Gulf's offshore fishery. Closure of the fall season will help insure the reproductive potentiel of newly molted crab present during this period.

RESUMÉ

Une pêche exploratoire du crabe des neiges a été établie au nord de l'Ile-du-Prince-Edouard (I.-P.-E.) avec l'émission de 16 permis exploratoires en 1985. Quatorze(14) nouveaux permis exploratoires ont été émis en 1986, pour un total de 30, et les

seize (16) permis exploratoires initiaux ont été ré-émis comme licenses en 1987. Aucun contingent n'a été établi pour cette pêcherie.

Durant la saison de pêche 1987, des caractéristiques biologiques ont été obtenues grâce à un programme d'échantillonnage en mer. La prise, l'effort et la distribution de l'effort de pêche ont été obtenus grâce aux carnets de bord des pêcheurs et des borderaux d'achat.

La distribution de l'effort de pêche indique la présence d'une concentration de pêche située au nord du centre de la zone 26. La concentration de pêche est délimitée par l'isobathe de 30 brasses et la limite de la zone de pêche de l'I.-P.-E..

La taille moyenne des crabes mâles pêchés a diminuée de 111,8 mm de largeur de carapace (LAC) en 1986 à 101,7 mm LAC en 1987. Les pourcentages de mâles morphométriquement immatures et sous-légaux ont augmenté dans les prises en 1987 à comparer à 1986. Ces augmentations peuvent être un signe positif pour le recrutement futur dans la pêcherie, mais indiquent aussi qu'il y a une baisse du nombre du gros crabes sur les fonds de pêche.

La prise par unité d'effort (PUE) a diminué de 45,4% de 1986 à 1987 (de 32,6 kg/casier levé à 17,8 kg/casier levé respectivement). La prise totale a diminué de 63% à comparer à 1986 (de 1239 t à 457 t). L'effort de pêche (calculé en divisant la prise totale par le PUE moyen) pour 1987 était de 25674 casiers levés, ce qui représente une diminution de 32% à comparer à 1986 (38003 casiers levés).

Les données de la saison d'automne de 1986 ont été combinées avec celles de la saison du printemps de 1987 afin d'estimer la biomasse initiale (B_0) présente après la période de recrutement dans la pêcherie. L'estimation de la B_0 en utilisant l'analyse de Leslie est de 689 t, ce qui donne un niveau d'exploitation, étant donné une prise totale de 519 t, de 75,4%.

Une réduction de l'effort de pêche s'impose si une augmentation de la PUE et une stabilité de la ressource sont visées. La saison de pêche devrait être réduite et coïncider avec celle pratiquée par les pêcheurs semi-hauturier du golfe. La fermeture de la saison d'automne aiderait à protéger le potentiel reproductif des crabes à carapace molle présents durant cette saison.

INTRODUCTION

An exploratory snow crab fishery was initiated off the northern coast of Prince Edward Island (PEI) in 1985 and is composed of management Areas 25 and 26 (Fig. 1). Exploratory fishing permits were increased from 16 in 1985 to 30 in 1986 (Comeau and Davidson, 1987). The initial 16 exploratory permits were issued as licenses for the 1987 snow crab fishing season. The fishermen are regulated to 30 traps, which are mainly 5' x 5' and 6' x 6' standard traps.

Fishing effort increased 150% in 1986 compared with 1985, 38003 trap hauls versus 15190 trap hauls respectively and resulted in a 54.6% increase in total catch (1239 t in 1986 versus 801.7 t in 1985; Comeau and Davidson, 1987). The mean CPUE for both management areas was 32.6 kg/trap haul in 1986 (Comeau and Davidson, 1987), compared with 52.8 kg/trap haul in 1985 (Davidson et al., 1986), which represents a decrease of 38.3%.

The PEI snow crab fishery was under no quota limitations and officially opens April 1st and closes November 30th. The following paper presents an assessment of fishery and biological trends for the 1987 PEI snow crab fishery.

MATERIALS AND METHODS

Sea sampling/port sampling

A sea sampling program for the 1987 fishing season was carried out by DFO personnel and contracted observers. Location of capture, size (carapace width-mm), sex and shell condition (either hard or soft: measured subjectively) was noted for all crabs sampled. Chela height was measured for males to determine morphometric maturity using the method described by Conan and Comeau (1986). The presence/absence of eggs and their state of development (orange, non-eyed or eyed) was noted.

Sea samples were obtained from Area 26 during weeks 4, 5, 6,(from May 31st to June 20th), 9, 10 (from July 5th to July 18th) and 23 (from October 11th to October 17th) of the fishing season. Weekly percentages of undersized males, immature males, soft shelled crabs and mean carapace size were calculated and plotted (Fig. 2). Only one port sample was obtained during the 23rd week. Monthly and seasonal size distributions and statistics were generated for the males.

Logbook and sale slips data

Catch/effort data for the PEI fishery was obtained from logbooks and processors sale slips by the Department of Fisheries and Oceans Electronic Data Processing and Statistics Branch. The resulting logbook data set was comprised of entries containing the following information:

a) Canadian Fisheries vessel (CFV) number;
b) date fished;
c) date landed;
d) fishing position: the geographical fishing position was reported in Loran C or latitude/longitude;
e) number of traps hauled;
f) catch - estimated by the fishermen (lbs).

From these data, catch (converted to kg) and CPUE (daily catch/number of trap hauls per day) were calculated and summarized into weekly intervals. The weekly data summaries were used in a Leslie analysis (Ricker, 1975) to determine Bo (initial biomass) and an exploitation level.

The geographical fishing positions were plotted to identify the major fishing effort concentrations.

RESULTS AND DISCUSSION

The distribution of fishing effort shown in figure 1 indicates one main fishing ground concentrated in the middle of area 26 and is delimited by the 30 fathom contour. A small concentration (5% of the total fishing effort) was reported at the border between area 25 and 26. Geographically, these two concentrations correspond to zone 1 and 2 of the 1986 fishing season (Comeau and Davidson, 1987). However, due to a small fishing effort at the 25/26 border and a comparable CPUE, the data was not separated into two zones for the 1987 analysis.

The CPUE fluctuated from 17.2 kg/trap haul to 12.9 kg/trap haul between the 2nd and the 8th week (from May 17 to July 4; Table 1). It then fluctuated downward to reach 8.7 kg/trap haul during the last week (week 11, July 19-25) of the first part of the season (May 10th to July 25th; Table 1). The CPUE was higher during the second part of the season (Oct. 4th to Nov. 14th; Table 1). The CPUE started at 17.6 kg/trap haul and then reached a high of 38.6 kg/trap haul during the 24th week (Oct. 18-24). It then fluctuated until the last week of fishing (Nov. 8-14) to reach 27.1 kg/trap haul (Table 1). The mean CPUE for the first part of the season was 15.1 kg/trap haul and was 28.5 kg/trap haul for the second part, which represents an overall mean CPUE of 17.8 kg/trap haul (Table 1). The mean CPUE for 1987 showed a decrease of 66.3% (from 52.8 kg/trap haul to 17.8 kg/trap haul) and 45.4% (from 32.6 kg/trap haul to 17.8 kg/trap haul) with that for 1985 and 1986 respectively. The total catch decreased by 63% compared with 1986 (from 1239 t to 457 t). The total effort for 1987 was 25674 trap hauls (calculated by dividing the total catch of 457 t by the mean CPUE of 17.8; Table 1) which represented a decrease of 32% from the 1986 fishing season (from 38003 trap hauls to 25674 trap hauls). Even with the 32% decrease of effort, the decrease of the mean CPUE from year to year suggests that effort is too high for the available biomass.

Comeau and Davidson (1987) indicated that the annual recruitment in the fishery corresponds most likely to the increased incidence of white crabs in the catch. That incidence of white crabs forced a mid-season closure for the PEI fishery each year (Davidson et al., 1986; Comeau and Davidson, 1987), which resulted in a spring fishery and a fall fishery. Thus, in order to use the Leslie analysis to estimate the initial biomass (B_o) between two recruitment pulses, the parameters of the fall fishery for a given year should be added to the parameters of the spring fishery of the following year. This approach was used this year by combining the data from September 7th to November 8th 1986 (Comeau and Davidson, 1987) and May 10th to July 25th, 1987 (Table 2). Consequently, the data from October 4th to November 14th (Table 1) should be used in the next year stock assessment with the data of the 1988 spring fishery. The CPUE increased from 31.8 kg/trap haul to a high of 41.5 kg/trap haul from the 1st to 5th week (Sept 7th to Oct 11, 1986) for the 1986 fall fishery (Table 2, Fig. 3). The CPUE gradually decreased from 41.5 kg/trap haul in the 5th week to reach 30.2 kg/trap haul in the 8th week, and dropped to a low of 18.0 kg/trap haul in the last week of the 1986 fall fishery (Table 2, Fig. 3). The downward trend observed in the last five weeks of the 1986 fall fishery continued on into the 1987 spring fishery (Table 2, Fig. 3). The mean CPUE was 22.7 kg/trap haul (Table 2).

The results of the Leslie analysis and their corresponding estimates of B_o and exploitation level (E.L.), assuming a total catch (Tc) of 519210 kg (Table 2), are as follows:

$$CPUE = 35.43 - 0.051\ k_t$$
$$r = -0.78$$
$$B_o = 689t\ (558t - 980t)$$
$$E.L. = \frac{Tc}{B_o} = 75.4\%$$

The overall size frequency distribution for 1987 (Fig. 4) shows an average size of 101.7 mm CW. This result shows a decrease in the average size compared with 1986 (111.8 mm CW). The mode observed at 114-116 mm CW for the 1986 fishing season (Comeau and Davidson, 1987; Fig 5) is not shown in the 1987 histograms (Fig. 4). A shift toward the smaller sizes is observed (Fig. 4). The monthly size distribution (Fig. 6) shows stable average size throughout the 1987 fishing season. The seasonal average size (CW) decreased from 1986, which may be a sign of a heavily exploited stock.

The percentage of morphometrically immature crab increased in 1987 compared with 1986 (between 7.0% - 15.6% in 1986 to 33%-58% in 1987, Table 3), as did the percentage of undersized crab caught (between 2.7%-20.3% in 1986 to 22%-53% in 1987; Table 3). The large number of morphometrically undersized immature crab may be a positive sign for future recruitment into the fishery. However, the

number of larger crabs seems to have diminished from the fishing ground as a result of heavy exploitation.

The percentage of white crabs was more stable in 1987 (Table 3) compared with the increase observed before the mid season closure in 1986 (Comeau and Davidson, 1987). The shell condition reported by observers was described as clean with pink color.

In summary: the decrease of the average size in the catch; the decrease of the mean CPUE for the third year; the increase percentages of morphometrically immature and undersized crabs in the catch; and the first estimation of an Bo for the PEI fishery with an exploitation level of 75.4% suggest that the effort is too high for the available biomass. A reduction in effort is advisable if increased CPUE's and long term stock stability are to be realized. The fishing season should be shortened as proposed by Comeau and Davidson (1987), to a season corresponding with the Gulf's offshore fishery. The closure of the fall season will also protect newly molted crabs, which constitute a portion of the reproductive potential of the stock and next year's recruitment, against overfishing.

ACKNOWLEDGEMENT

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TABLE 1 - Weekly effort and catch data for the 1987 Prince Edward Island snow crab, Chionoecetes opilio, fishery (Areas 25 and 26).

WEEK*	Total catch C_t (kg)	$C_t/2$ (kg)	# traps hauls	CPUE (kg/trap haul)	Cummulative catch k_t (t)
1- May 10-16	1805	902	180	8.5	0.9
2- May 17-23	32117	16059	1245	17.2	17.9
3- May 24-30	46705	23353	1245	18.9	57.3
4- May 31-June 6	30777	15389	1380	13.1	96.0
5- June 7-13	29950	14975	1165	15.9	126.4
6- June 14-20	34960	17480	910	18.9	158.8
7- June 21-27	40464	20232	1095	15.9	196.5
8- June 28-July 4	31990	15995	650	12.9	232.8
9- July 5-11	21622	10811	534	7.2	259.6
10- July 12-18	10668	5334	285	8.7	275.7
11- July 19-25	6886	3443	199	8.6	284.5
12- July 26-Aug 1	-	-	-	-	-
13- Aug. 2-8	-	-	-	-	-
14- Aug. 9-15	-	-	-	-	-
15- Aug. 16-22	-	-	-	-	-
16- Aug. 23-29	-	-	-	-	-
17- Aug. 30-Sept 5	-	-	-	-	-
18- Sept. 6-12	-	-	-	-	-
19- Sept.13-19	-	-	-	-	-
20- Sept.20-26	-	-	-	-	-
21- Sept.27-Oct. 3	-	-	-	-	-
22- Oct. 4-10	9442	4721	129	17.6	292.7
23- Oct.11-17	40682	20341	834	22.8	317.7
24- Oct.18-24	52713	26356	615	38.6	364.4
25- Oct.25-31	27360	13680	390	26.8	404.5
26- Nov. 1- 7	16573	8287	140	34.4	426.4
27- Nov. 8-14	21924	10962	148	27.1	445.7
Total=	456638		Total=11174**	Mean= 17.8	

* The season was officially opened April 1st 1987 and closed November 30th 1987. The fishermen fished from May 14th to November 14th. There was a closure from the 12th to the 22nd week (July 23rd to October 7th) due to a high incidence of white crabs in the catch reported by processors.

** Total effort for this season is estimated at 25674 trap hauls (calculated by dividing the total catch of 457 t by the mean CPUE of 17.8 kg/trap hauls).

TABLE 2 - Weekly effort and catch data for September 7th to November 8th 1986 and May 10th to July 25th 1987 for the Prince Edward Island snow crab, Chionoecetes opilio, fisheries (Areas 25 and 26).

	WEEK	Total catch C_t (kg)	$C_t/2$ (kg)	# traps hauls	CPUE (kg/trap haul)	Cummulative catch k_t (t)
	Sept 7-13	954	477	30	31.8	0.5
1	Sept 14-20	36135	18068	1337	27.0	19.0
	Sept 21-27	66194	33097	2109	31.4	70.2
9	Sept 28-Oct 4	47454	23727	1418	33.5	127.0
	Oct 5-11	28648	14324	690	41.5	165.1
8	Oct 12-18	24230	12115	705	34.4	191.5
	Oct 19-25	24755	12377	770	32.1	216.0
6	Oct 26-Nov 1	1814	907	60	30.2	229.3
	Nov 2-8	1082	541	60	18.0	230.7
	May 10-16	1805	902	180	8.5	232.0
	May 17-23	32117	16059	1275	17.2	249.1
1	May 24-30	46705	23353	1245	18.9	288.5
	May 31-June 6	30777	15389	1380	13.1	327.3
9	June 7-13	29950	14975	1165	15.9	357.6
	June 14-20	34960	17480	910	18.9	390.1
8	June 21-27	40464	20232	1095	15.9	427.8
	June 28-July 4	31990	15995	650	12.9	464.0
7	July 5-11	21622	10811	534	7.2	490.8
	July 12-18	10668	5334	285	8.7	507.0
	July 19-25	6886	3443	199	8.6	515.8
		Total= 519210		Total=16097	Mean= 22.7	

TABLE 3 - Biological characteristics of snow crab, Chionoecetes opilio, present in sea samples during the 1987 Prince Edward Island, Area 26, snow crab fishing season.

WEEK*	Total number of observations	Mean size (mm)	% of immature crab (N)	% of white crab	% of undersized crab
1- May 10-16	-	-	-	-	-
2- May 17-23	-	-	-	-	-
3- May 24-30	-	-	-	-	-
4- May 31-June 6	184	105.6	33%(163)	10%	22%
5- June 7-13	363	101.4	58%(343)	13%	36%
6- June 14-20	393	100.7	56%(378)	19%	37%
7- June 21-27	214	97.2	38%(208)	2%	53%
8- June 28-July 4	-	-	-	-	-
9- July 5-11	199	100.5	47%(191)	3%	38%
10- July 12-18	695	102.9	54%(681)	12%	27%
11- July 19-25	-	-	-	-	-
12- July 26-Aug 1	-	-	-	-	-
13- Aug. 2-8	-	-	-	-	-
14- Aug. 9-15	-	-	-	-	-
15- Aug. 16-22	-	-	-	-	-
16- Aug. 23-29	-	-	-	-	-
17- Aug. 30-Sept 5	-	-	-	-	-
18- Sept 6-12	-	-	-	-	-
19- Sept 13-19	-	-	-	-	-
20- Sept 20-26	-	-	-	-	-
21- Sept 27-Oct 3	-	-	-	-	-
22- Oct 4-10	-	-	-	-	-
23- Oct 11-17	213	101.8	57%(213)	16%	28%
24- Oct 18-24	-	-	-	-	-
25- Oct 25-31	-	-	-	-	-
26- Nov 1- 7	-	-	-	-	-
27- Nov 7-14	-	-	-	-	-

* The season was officially opened April 1st 1987 and closed November 30th 1987. The fishermen fished from May 14th to November 14th. There was a closure from the 12th to 22nd week (July 23rd to October 7th) due to a high incidence of white crabs in the catch reported by processors.

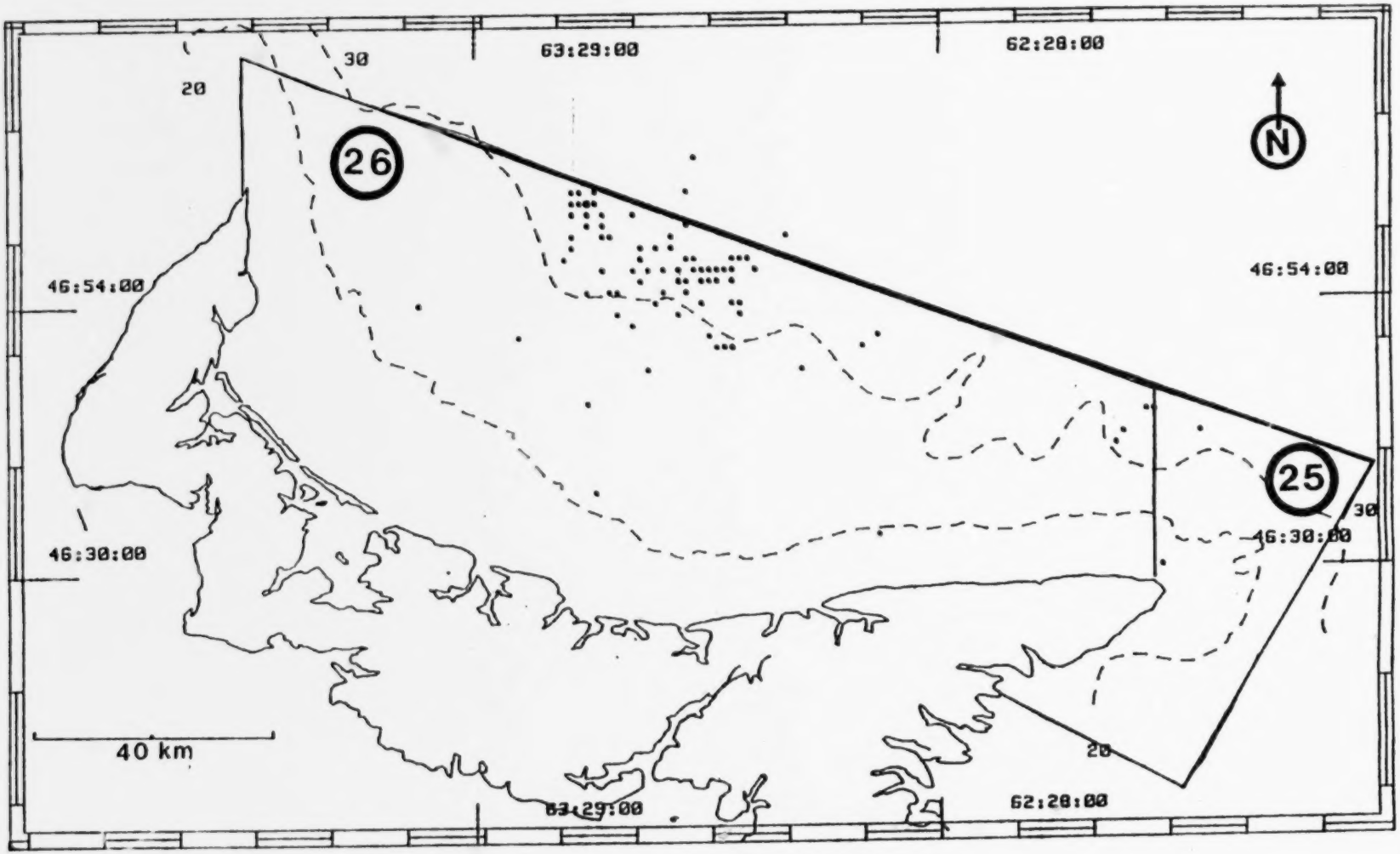

FIGURE 1- Distribution of fishing effort for the Prince Edward Island snow crab, Chionoecetes opilio, fishery in 1987 for fishing Areas 25 and 26.

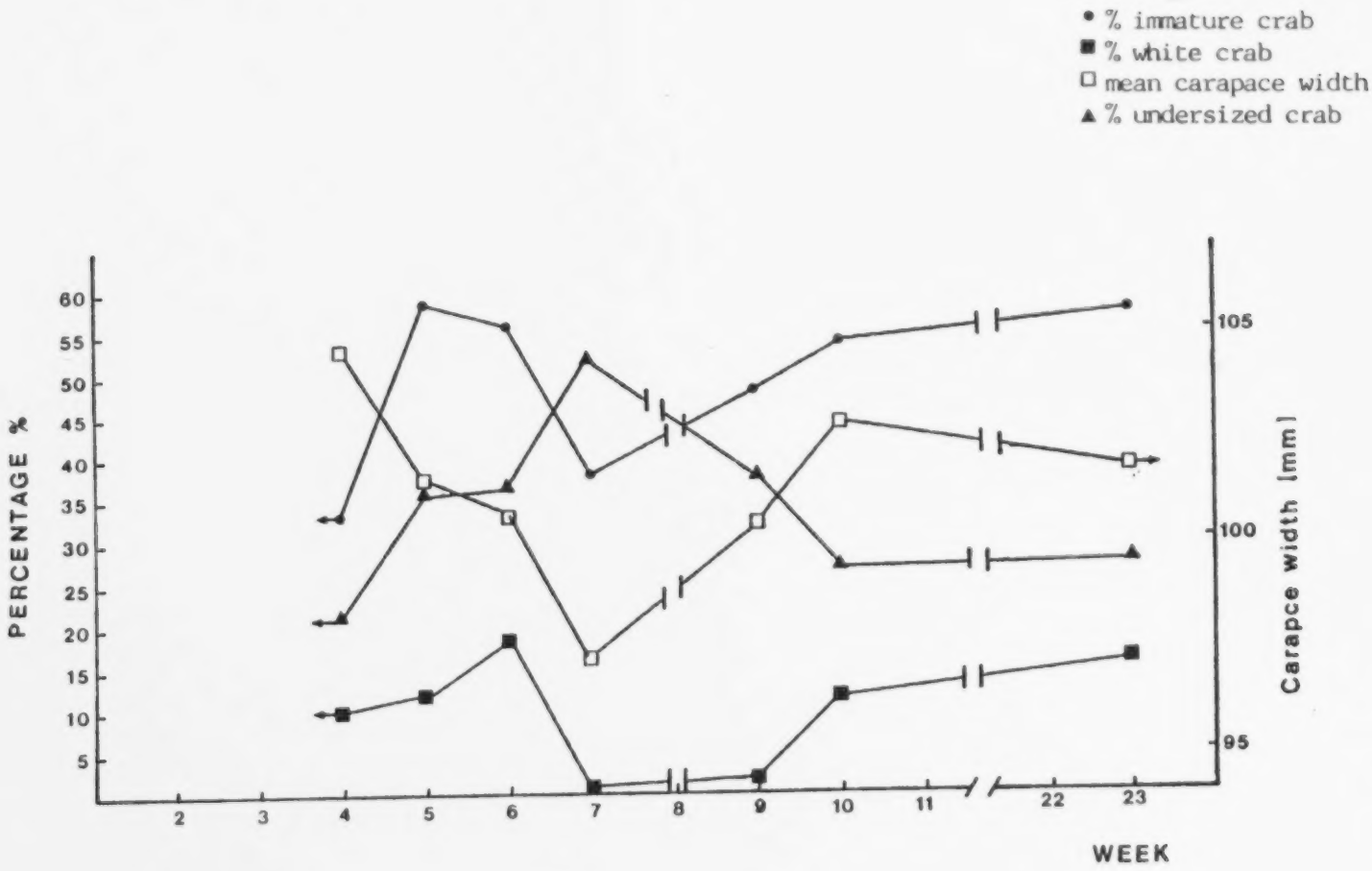

FIGURE 2- Weekly fluctuations of the percentage of immature crab, undersized crab and white/soft shelled crab present in sea samples from area 26 during the 1987 PEI snow crab fishing season.

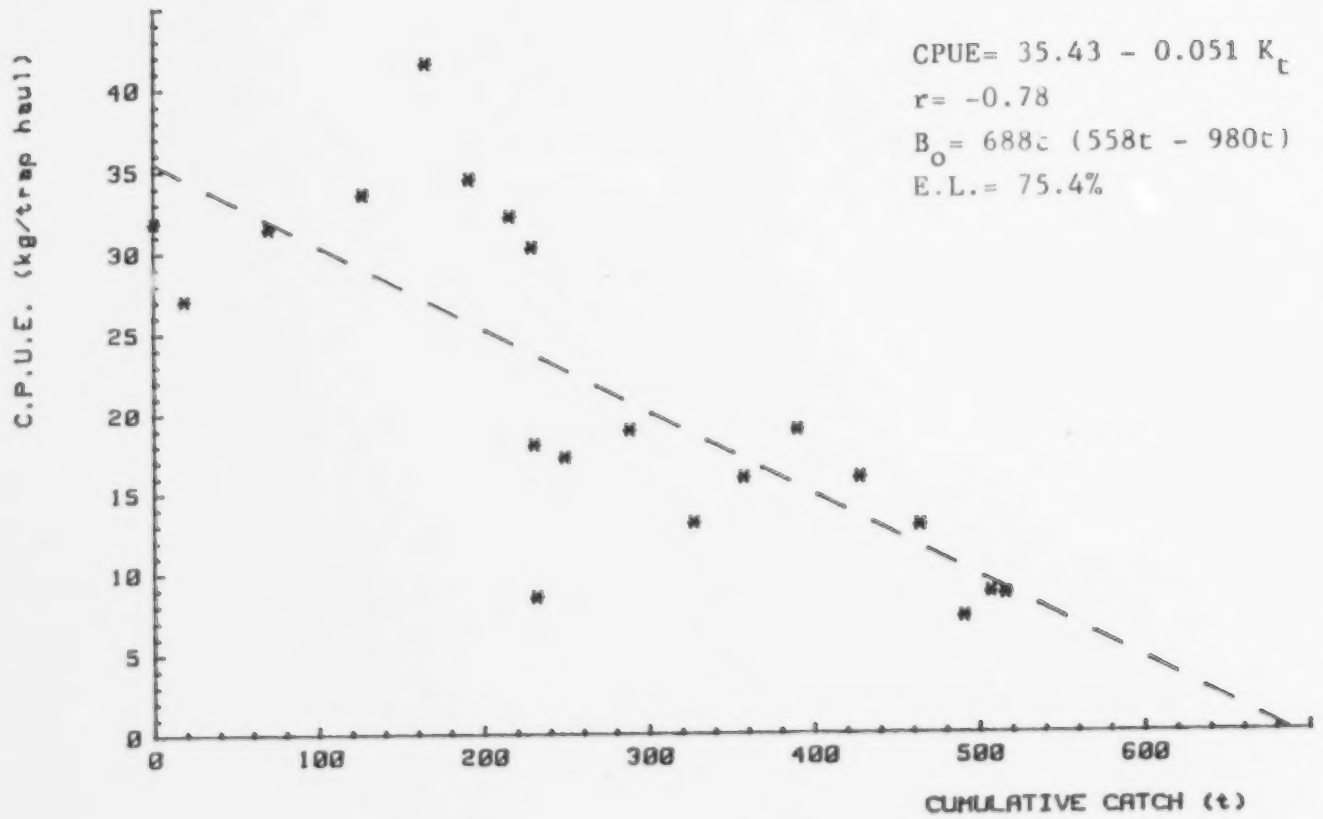

FIGURE 3- Cumulative catch (t) versus mean weekly catch per unit effort (C.P.U.E. kg/trap haul) for the last part of the 1986 snow crab fishery (from Sept. 7th to Nov. 8th) and the first part of the 1987 snow crab fishery (from May 10th to July 25th) in Prince Edward Island Areas 25 and 26.

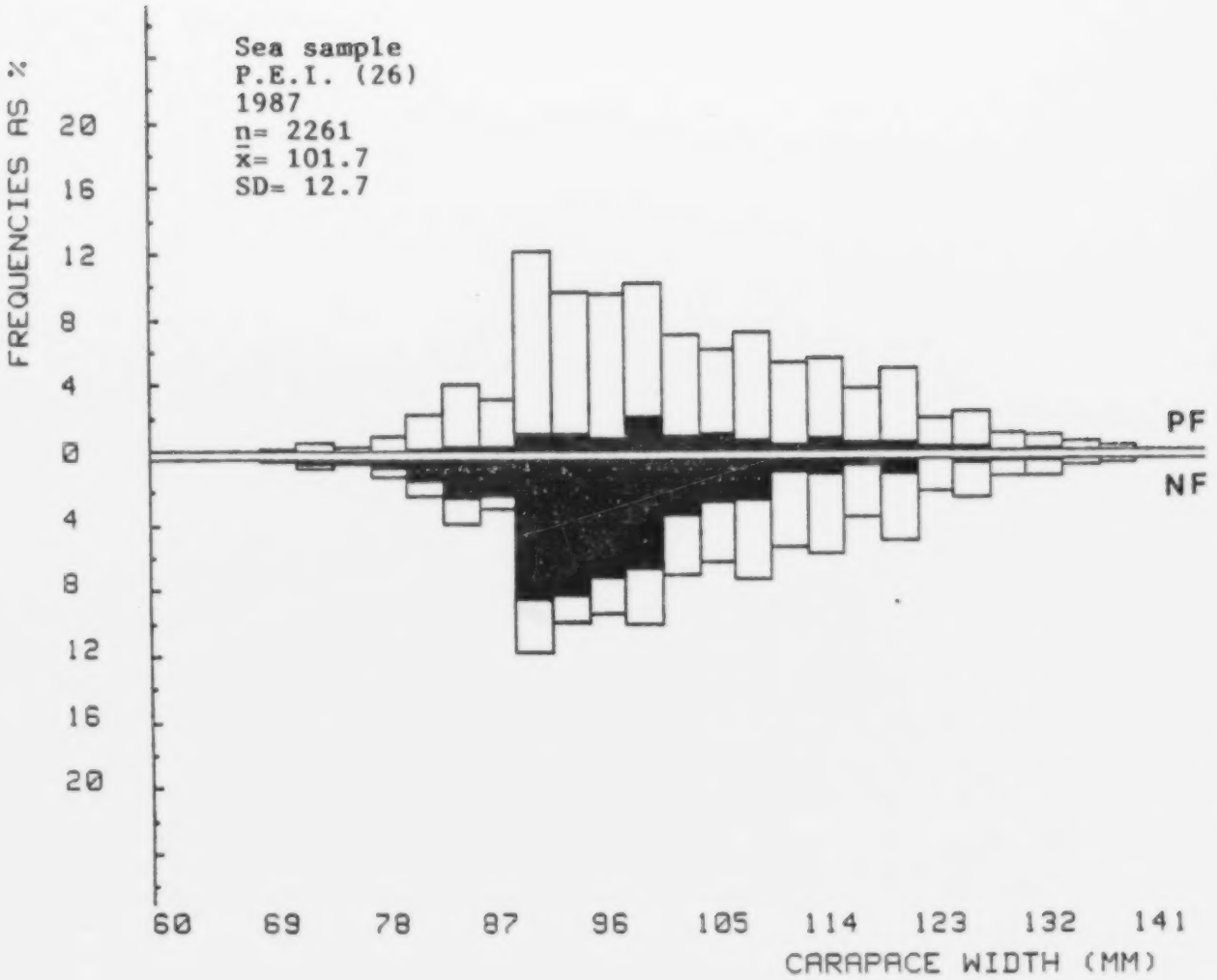

FIGURE 4- Seasonal size frequency distribution of male snow crab, Chionoecetes opilio, present in sea samples taken during the 1987, area 26, Prince Edward Island snow crab fishery.

PF: Total number of observation (%), percentage of soft crab in black.
NF: Percentage of mature in white, percentage of immature in black.

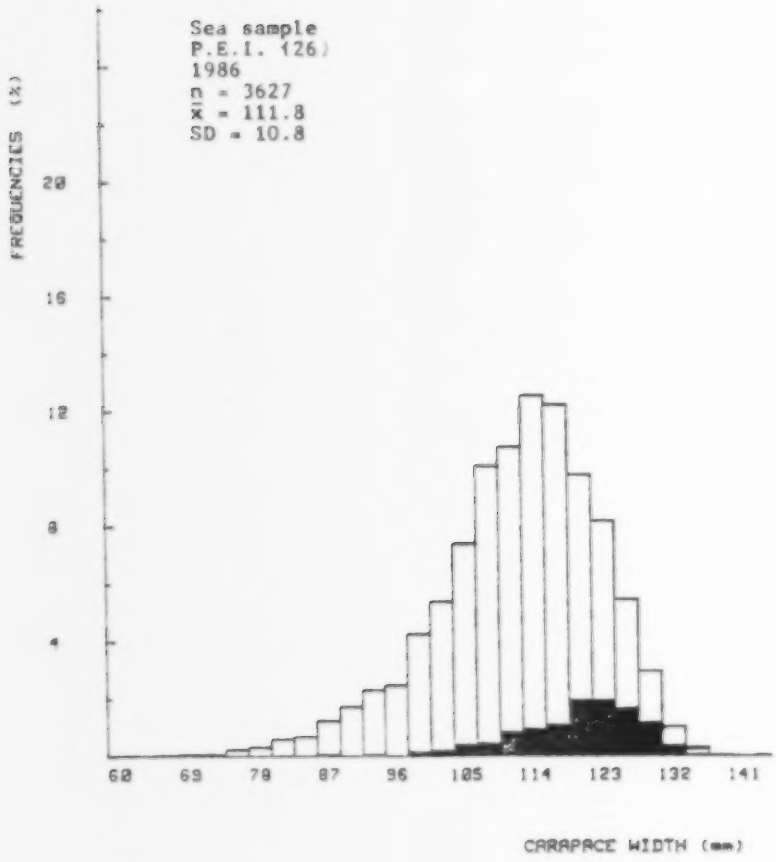

FIGURE 5- Seasonal size distribution of male snow crab for the 1987 PEI fishery. (after Comeau and Davidson, 1987)

■ = white/soft crab

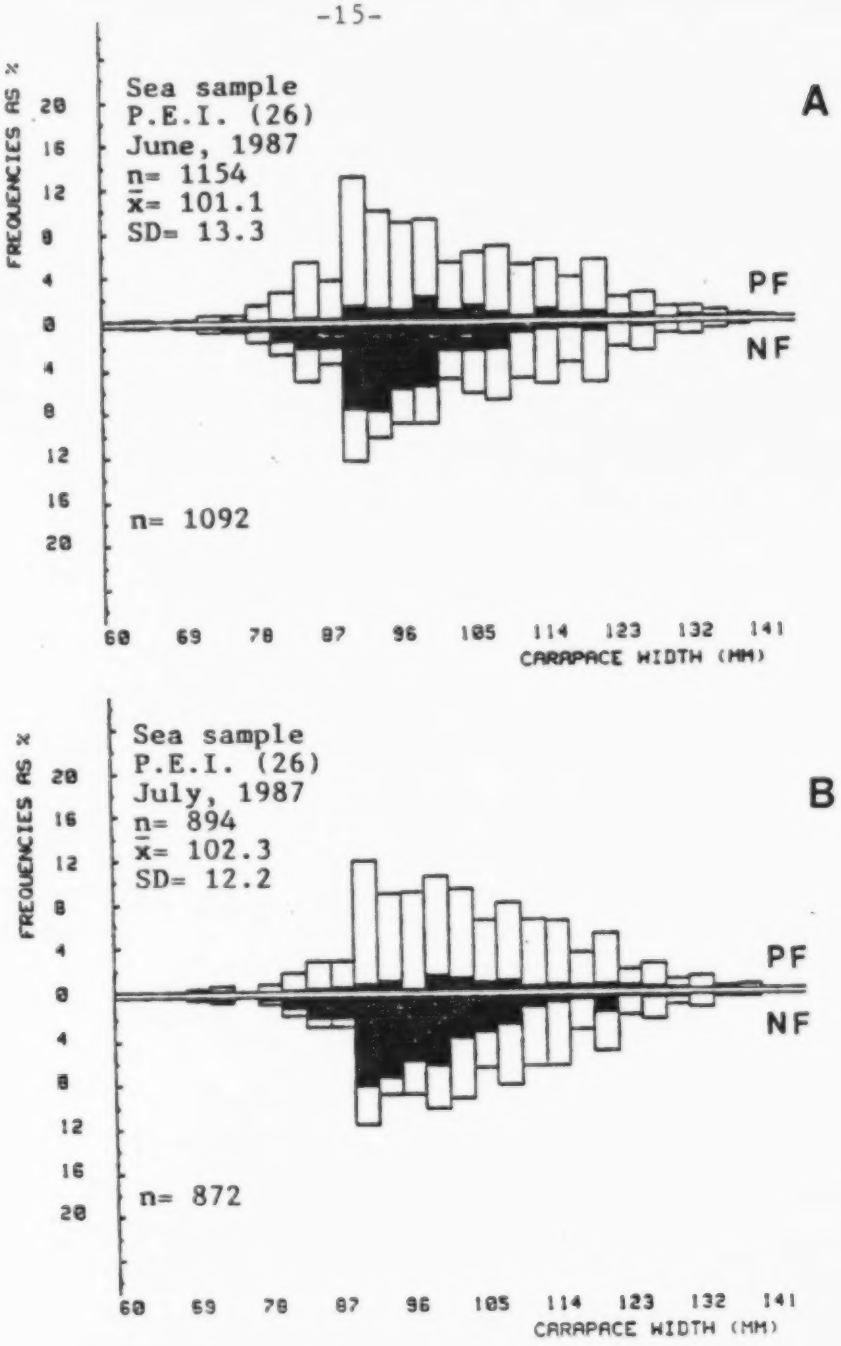

FIGURE 6- Monthly size distributions of male snow crab, Chionoecetes opilio, present in sea samples (A,B,C) and port sample (D) taken during the 1987, area 26, Prince Edward Island snow crab fishery.
PF: Total number of observation (%), percentage of soft crab in black.
NF: Percentage of mature in white, percentage of immature in black.

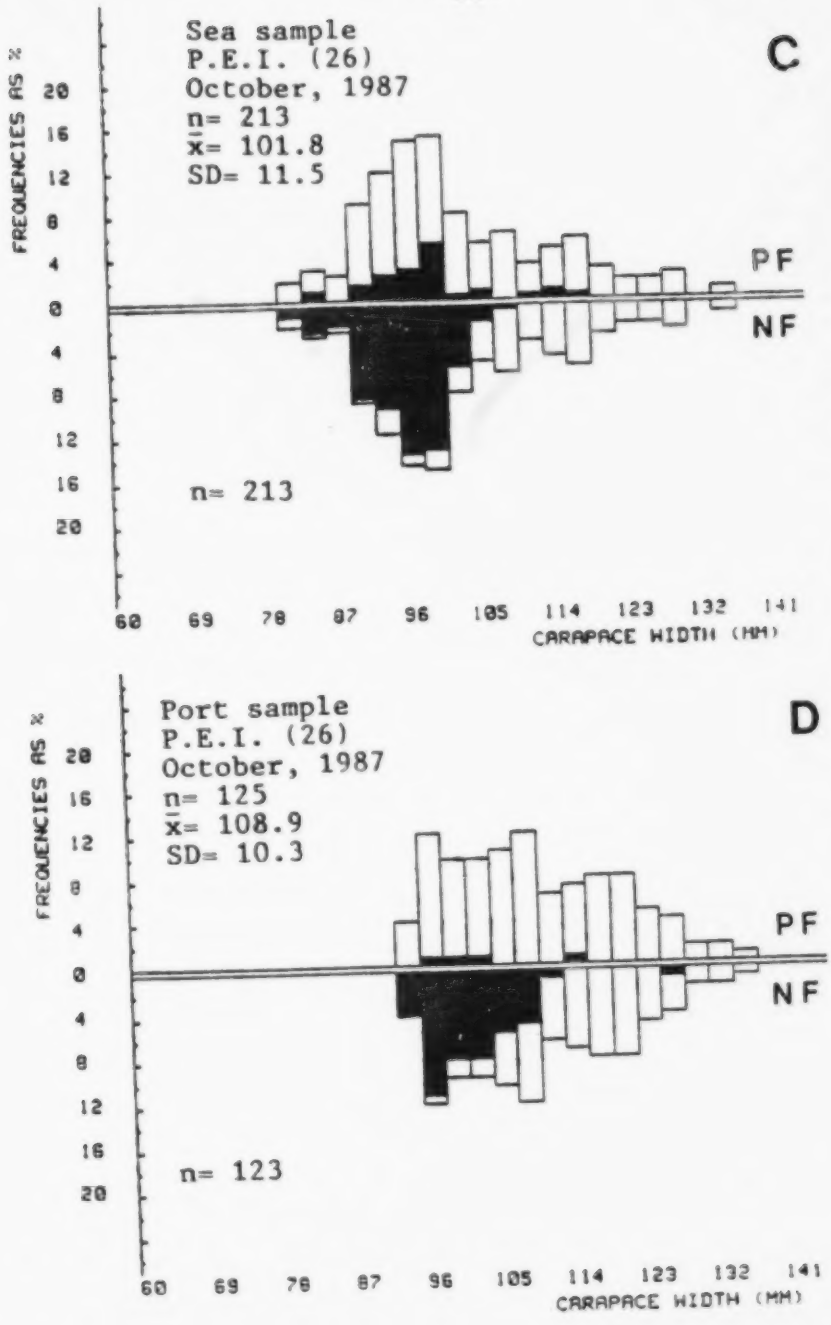

FIGURE 6- cont.